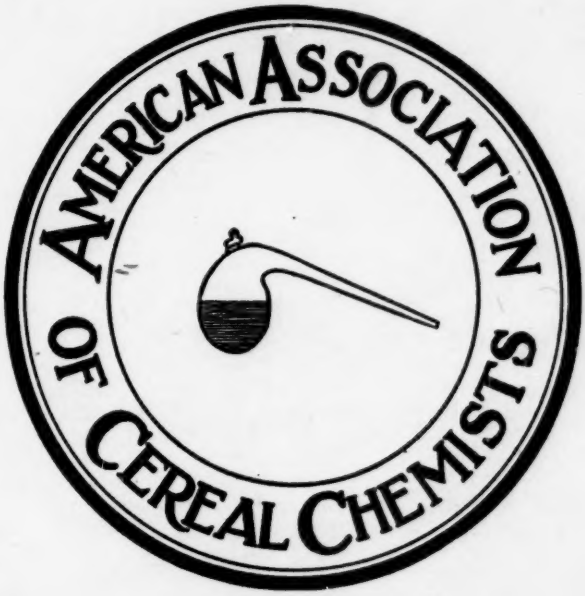
THE JOURNAL

OF THE



Vol. II DECEMBER, 1916 No. 1

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THE JOURNAL
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of
CEREAL CHEMISTS

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Vol. II DECEMBER, 1916 No. 1

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Our Last Meeting and Some Results

The spring meeting of our association has long since been history, but it will do no harm to review some of the events of that meeting and thereby refresh our minds somewhat. The attendance was not all that could be desired because, in several cases, our members were not permitted to leave their posts while the miller was away. What was lost, however, by having the meeting at the same time that the millers had theirs, was made up by the good derived from the presence of several of the boys from the Northwest. There have been persons who desired to belittle our efforts as an association by striving to create the impression that this was a society of Kansas, or Southwestern chemists. The presence of members from a distance at the regular meetings will provide food for thought in such cases.

It is true that the association was first organized in Kansas City, Mo., but at the present writing we have interested and active members on both sides of the Atlantic and in Canada.

There are many men who see the need of such an organization as this and are willing to support it as much as possible. However, like many other undertakings, the beginning finds a wealth of raw material which must be developed before it is serviceable. We have members who could lend a strong hand without much personal effort but they do not realize it.

Now if each one will read the minutes of the meeting he will see what we most lack. That is, positive views reenforced by honest comparison and backed by proof. We have had too much assertion and too little proof. In an effort to get some points cleared up, our president, Mr. Weaver, appointed the entire membership as a committee to investigate them. As a result, we should have some good papers at our next meeting. In answer to recent inquiries, a number of the boys said that they had special work under way but had not had time to do enough to draw conclusions from at this time. This shows that the "ferment" of argument is having its results.

Several new names were voted upon and as a result our membership was increased by five. These names and several since voted upon make our membership about thirty. An amend-

ment to the constitution was voted upon favorably which will permit the acceptance of new members at any time. This will materially aid the membership committee.

Some good letters from members unable to attend were read by President Weaver, and one and all, showed a spirit of interest and enthusiasm that was gratifying. These letters were, possibly, the inspiration of the suggestion by Mr. Porter, that a closer bond between the members might be developed by the circulation of a general letter to which each, in turn, might add his comments and suggestions. That idea has been followed out and has proven to be a good one.

During the first session of the meeting attention was called to the criticism of the resolution adopted at the February meeting in Wichita, dealing with the subject of "Gluten." While on that occasion, the members had in mind merely the idea of standardizing the quantitative determination of the nitrogenous content of cereal products and grain, the resolution is so stated as to make it possible to construe it to cover the so-called qualitative determination. This was an unfortunate condition and the members voted to revise the resolution so as to make the wording more concise.

The work was completed the second day of the meeting and part of the members went home and part remained to attend the sessions of the F. O. M. A. Those that found it necessary to return at once missed some of the good talks at the millers' meeting.

Now a few words about the future. Are you planning to meet with us next spring? Will you have a report to make on one or more subjects? Are you hard at it now, striving to disprove some of those "false" statements you heard last time? Do you know whether the same results can be accomplished in the laboratory with a low yeast and long fermenting period as by higher yeast and shorter fermenting period? Is 40° C. a satisfactory temperature for the digestion of samples for the determination of sugar and total solids? Should the solution for acidity, sugar and solids be separated from the sample by simple filtration centrifuging, or by suction? Shall we recommend the use of toluene in the solution for sugars and acidity? Can the stage of a dough be determined by its acidity content and how will such acidity be determined? Have you tried out President Weaver's suggestion for determining "soundness" in flour and wheat? Are you using sodium alizerine sulphonate for indicator in nitrogen determinations? How about the proposed method for crude fibre? Can you get there as fast by that method as by double filtration?

Remember! These things will have to be settled and that in your day, so you had better get wise and be ready to cast an intelligent vote.

The Executive Committee have not decided, as yet, on the place for the next meeting. Your suggestions will be welcomed. It will be held wherever the largest attendance can be assured, and it is hoped that it will be possible to have it when and where the fellows up north can attend. The committee is already assured of several "good" talks and it will be to your interest to hear them.

Watch your step.

SOMETHING DONE

We must heartily agree with Mr. James Meikle, who said in an article appearing in *Milling* for October twenty-first, that "the ventilation of this subject must result in nothing but good." Since the appearance of the last issue of our little journal, there have been many discussions presented bearing on the general topic, "Protein vs. Gluten." These articles serve to prove that there is a

need for such an organization as ours is. Those who have taken the most active part in these discussions are men and women who represent laboratories doing work for many hundreds of clients and these clients in turn transacting business between one another in which the chemist's results may have a bearing. How easy for confusion and dissatisfaction to occur when they are not all in unison. How can they avoid misunderstandings when they are not all held to strict definitions and standards?

Some have stated their views plainly and made suggestions that are constructive while others have been satisfied to merely ridicule. To those of the first class we owe a debt of gratitude, and we trust they will be inclined to join with us in the future and help in the formulation of such standards as we feel are warranted. The difference in the ideas and the methods of some of those who have put their thoughts in print are illustrated by the extracts that are here listed. They have all been written since the appearance of our last Journal, in May. After reading these it is difficult to see wherein certain persons can claim that our organization is unjustified.

"As already stated the prophesying of the baking qualities of a flour from a gluten test is a tough proposition."—JAMES MEIKLE, in *Milling*.

"Gluten: This test denotes the *amount* of the gluten contained in the flour and is determined by obtaining the amount of nitrogen by the official Kjeldahl-Gunning method, and multiplying by factor 5.7, and not by the wash method of obtaining the wet and dry gluten. This denotes the strength of the flour."—JOHN A. WILSON, in *Southwestern Grain & Flour Journal*.

"It must be borne in mind that the tests on gluten of wheat are made in the interest of the miller. He is entitled to know how *much* gluten he will carry to the rolls in his wheat."—CARL G. HINRICHS, in *Southwestern Grain & Flour Journal*.

"The definition (crude gluten) states specifically that crude gluten is obtained by washing and, hence, no chemical method can be applied.

"In many flours it so happens that the crude gluten and the crude protein are approximately the same in amount. * * *

"This makes it easy to confuse the terms. While this condition prevails in many flours, it is by no means true of all and the making of one determination and reporting it under the name of another has been responsible for the misunderstanding and confusion of terms."—L. DUNTON, Kans. State Agr. College, in *Operative Miller*.

"After a considerable amount of experimenting on different flours it was found that the results by hand-washing agreed very closely with those obtained by determining the nitrogen and multiplying the result by the factor 5.7. After due consideration of all the points involved the latter method was adopted as that best suited to give the information required on the many samples of flour submitted for examination. * * *

"It (referring to the above) has given all the information that has been necessary in the connection in which it has been used, and has given it much better than it could have been given by the hand-washing method."—GEORGE L. TELLER, in *Modern Miller*.

"It must be remembered that the nitrogen of a wheat or flour is a fixed and easily determined quantity. On the other hand, the actual amount of gluten present in a dough from the same flour varies with the conditions under which the dough was made; it obviously follows that the quantity extracted by competent methods cannot, under the different conditions, be the same."—WILLIAM JAGO, in *Milling*.

Thus we see the doctors disagree. Surely the patient has suffered enough. What shall we do about it?

Why do some experts and officials insist on reporting "*per cent. of gluten*" when government experts unhampered by the demands of speed do not check one another within several per cent? Are our milling and grain dealing friends so incompetent that they can not see the advantage of our being honest and admitting that to measure the *amount of gluten* is not possible in a satisfactory manner, but that protein can be accurately measured?

Gentlemen, we are going to win out in this matter. We are on the right side and that is half the contest. The demand for standard methods suitable for control work is upon us and they must be provided. The

science of chemistry isn't a "By guess and by gosh" affair, the steel industry and others have found out the value of chemical information and it is a settled fact that when we learn a little about the science of cereal chemistry that we will be able to agree on some things and learn how to apply what we do know. Take a fresh hold now and be prepared for the next meeting, and let us remember that the surface of things in cereal chemistry has been but scratched. There is a world of knowledge to be gained, so let us know about it.

MINUTES OF ST. LOUIS MEETING OF THE AMERICAL ASSOCIATION OF CEREAL CHEMISTS, MAY 29-30, 1916.

Meeting opened with a short speech by President Weaver. The first business to come up before the Association was the correction of the resolution on protein as published in the May Journal. President Weaver appointed Messrs. Buck and Patterson to revise the measure.

Next followed the election of the following new members:

J. B. Mudge, Bowersock Mills, Lawrence, Kans.

A. J. Banks, Ogilvie Mills, Montreal, Canada.

A. H. Porter, New Prague Mills, New Prague, Minn.

The methods published in the May Journal were then read by the Secretary.

Reports were circulated in meeting showing results on Samples A, B, C, and D, which were sent out to members for comparative methods.

President Weaver then read letters from the following: A. A. Jones, A. W. Estabrook, and E. G. Wahlin, commenting on methods.

Mr. Mitchell read an article by Mr. Southwell, describing comparisons of various methods for sugar determinations, and commenting upon their merits.

A general discussion on methods followed. Mr. Hogan then read a report on baking based upon an average of the formulas in use in fifteen bakeries in Kansas City.

Mr. C. J. Patterson moved that a committee be appointed to investigate "Fermentation" to determine if high yeast content in the dough will bring the dough to the point of acetic fermentation more rapidly than a low yeast content, using a longer fermentation. The President appointed the following committee:

P. M. Patterson, C. F. Buck, C. J. Patterson, J. Hogan, F. P. Loomis, R. W. Mitchell, A. H. Porter.

President Weaver, in discussing the reporting of the color value of flour and bread, suggested the use of the words in place of the numercial value, as proposed in the May Journal.

Mr. Mitchell moved to adopt a uniform sheet, with formula printed on face of it. Motion carried. President Weaver appointed Mr. J. M. Hogan to draw up such a sheet. On further discussion, however, it was decided advisable for all members to exchange report sheets in use at present and leave the final decision until our next meeting.

Mr. A. H. Porter, of New Prague, next gave a discussion on wheat and flour conditions in the Northwest, as seen from the laboratory.

Mr. C. J. Patterson moved to have a committee appointed to investigate methods for the clarification of solutions for the determination of sugar, and also the effect of varying temperatures and times of extraction. President Weaver appointed all members of the Association to this committee.

Meeting adjourned to Tuesday, May 30, 1916.

Meeting opened 9:00 A. M.

Reading of revised resolution on protein by C. J. Patterson:

RESOLVED: That this Association wishes to discontinue the use of the term "gluten," except as applied to product obtained by

washing a quantity of dough in water, the chemically determined nitrogenous value of wheat and flour to be termed "protein," and to be calculated from the percentage of nitrogen times the prtein factor 5.7; the determination on wheat to be made on the whole wheat meal.

In cases where "gluten" is desired it shall be made clear in reporting, that gluten is the washed-out, impure product and will be reported as such, and protein represents the chemical determination for the N-value.

Motion carried as read.

Mr. M. E. Shultz elected to membership.

President Weaver appointed following committee to have charge of the collection and comparison of all forms, and submit a uniform sheet for consideration at the next meeting: C. J. Patterson, J. M. Hogan, and A. W. Estabrook.

Acting on Mr. A. H. Porter's suggestion, it was moved and carried to adopt a plan of a circulating discussion by correspondence, to carry on work of the Association between meetings. President Weaver appointed Messrs. Mitchell and Southwell to map out a route for forwarding of the papers compiled in the discussion.

Short discussion on *amino-nitrogen* in flour, and relation to condition of flour. No definite value to be attached in view of experiments conducted by C. J. Patterson and P. M. Patterson.

Mr. Mitchell questioned the Association on methods to arrive at acidity of dough. No definite method suggested, owing to the difficulty in breaking up the dough.

President Weaver described tests upon the relation of the stability of gluten, to its bread making value, by soaking a well washed gluten ball in water at 80° and noting its condition after from 18 to 24 hours. He wished to suggest that all members become familiar with this test and to report their opinion as to its value.

Motion to eliminate Section 5 of the Article on Membership in the Consitution. Section 2 to be changed so as to read: "All applications for membership must be passed upon by a body known as the Executive Committee, their decision to be final." Motion carried.

Moved and carried that *proposed* method on the determination of protein in wheat be accepted as an *approved* method.

Motion to eliminate the word "male" in Section 1, Article on Membership. Motion lost.

Next followed the election of officers, all officers being re-elected:

President.....H. E. Weaver
Vice-President and Bus. Manager, A. R. Sasse
Secretary-Treasurer.....P. M. Patterson
Editor.....R. W. Mitchell
Chairman Ex. Committee...C. J. Patterson

Before adjournment, a general discussion was held, on the question of financing the Journal. No decision was reached, although several excellent plans were suggested. This subject is to be settled at the next meeting, it not being urgent at present.

Mr. C. J. Patterson announced the following members appointed to the executive committee: A. A. Jones, J. M. Hogan, A. W. Estabrook.

Meeting adjourned.

Those present were as follows:

A. J. Patterson, Ismert-Hincke, Kansas City, Kans.

C. F. Buck, Kansas Flour Mills Co., Enterprise, Kans.

J. M. Hogan, Kansas Flour Mills, Kansas City, Kans.

R. W. Mitchell, Kansas Milling Co., Wichita, Kans.

A. H. Porter, New Prague Flour Mills, New Prague, Minn.

F. H. Loomis, Wichita M. & E. Co., Wichita Falls, Texas.

H. E. Weaver, Larabee Flour Mills Co., Hutchinson, Kans.

A. W. Estabrook, Estabrook, Cer. Lab., Kansas City, Mo.

P. M. Patterson, Modern Baking Co., Hutchinson, Kans.

M. E. Shultz, Geo. P. Plant Milling Co., St. Louis, Mo.

NOTICE

In order that the work of the members may be most effective and the results most valuable it is the desire of President Weaver that every member at once advise him of the character of research work that he is doing. If you have no work under way at the present time and are willing to accept a suggestion, then let President Weaver know, and he will be able to direct to your attention some phase of the work that would otherwise go undeveloped. Please take this as a personal suggestion and follow out this suggestion for the good of the society and the work that we have before us.—*Committee.*

CORRECTION

In the last issue of this Joural there was an error in the article entitled, "Report on Moisture Determination." The last three lines of the table were not included; they are here given in order that the conclusions may be true:

Sample No.	Dish No. 3 Covered	Dish No. 6
	%	%
16	13.7	12.2
17	13.5	13.1
18	13.8	12.7

FERMENTATION

In a recent meeting of the Association, the business of adopting a uniform baking test was under way. When the question of the proper fermentation was submitted in this manner: Which one, the fast or slow dough method would be suitable for all kinds of flour giving the flour the most rigid test, and at the same time be practical in the laboratory?

Some preferred a long, or slow dough method. The opposition to this was met with the question of time, in that too many methods used in the laboratory are of long duration, and this brings every thing to a close at the same time.

So the final question, "Why not use a larger per cent of yeast?" In this way reducing the time, and at the same time give the flour a very rigid test. This too, met with opposition, saying it could not be done. So President Weaver gave every member the problem, "Will a large quantity of yeast for a fast dough produce acetic acid fermentation in the same ratio as will a small quantity of yeast for slow dough?" If so the large quantity of yeast or fast dough would give the same rigid test in a much shorter time than the slow dough.

I wish to submit my results as follows: The procedure followed was to take five grams of dough just before going to the pan, and after it had been thoroughly turned, disintegrating with sand by trituration and titrating with N-20 NaOH. The amount reported being the number of cc of N-20 NaOH it took to completely neutralize the acidity of the dough. The end point was made very distinct.

TABLE No. 1

% Yeast	Temperature	Hours	Minutes Fermented	Cc. NaOH
3.	90 F	1	40	2.3
1.25	90 F	1	50	1.9
1.25	90 F	2	10	1.8
3.	90 F	2	45	2.9
1.25	90 F	4	00	2.1
3.0	90 F	2	00	2.3
1.25	90 F	3	10	2.2
3.0	92 F	3	20	3.0
1.25	92 F	3	20	2.5

The following table gives the results obtained by running the acidity on the dough every hour for six hours:

TABLE No. 1

3.0	2.6	90 F	3
	3.5	90 F	4
	3.7	90 F	5
	3.8	90 F	6
1.0	2.3	90 F	3
	2.6	90 F	4
	2.8	90 F	5
	2.9	90 F	6

It is easy to see that the small per cent of yeast produces the highest amount of acidity in the same length of time, in proportion to the amount of yeast used.

The work was carried on for 20 days, giving a fair test, and it will be noticed that they compare very well.

The conclusion is that the samll per cent of yeast will give the more rigid test in proportion to the yeast used than the larger per cent of yeast with a saving of yeast and a loss of time.

But the high amount of acidity produced by the high amount of yeast used gives results much more desirable and more suited to laboratory practice.

A word on the methods adopted and those considered by the Association at the February meeting, Wichita, Kans.:

The methods that were before the meeting were the methods most used and of the most importance. And I think that every member in considering each method in order, had one thought especially in mind, and that thought was, "Will this method save the greatest amount of time and at the same time develop the greatest amount of accuracy?" A uniform baking test is very important and must be obtained. But I am not in favor of the method adopted at the Wichita meeting.

The amount of flour to be used in this method is too small, the fermenting period too long, and the amount of yeast too small. I would suggest a larger amount of flour, and a larger amount of yeast. This of course would give a much faster dough, and more suitable for experimental purposes.

Color of flour:

I would suggest that the standard, say for the patent, 98 to 100, be made greater by at least twice that number.

With these exceptions I wish to say that the methods acted upon at the winter meeting are suitable for work in the different industrial and commercial laboratories.

—C. J. PATTERSON.

A NEW FILTERING APPARATUS

Some of you, perhaps, have had a great deal of trouble with filtering aqueous solutions of flour and, no doubt, have wished for a more rapid method of filtering these solutions.

I have devised and have in use in my laboratory a vacuum filtering outfit for this purpose which has proved very satisfactory and I will give you a brief description of it.

I have had copper funnels made with a brass wire screen having about 120 meshes to the inch, set in the funnel up a short distance from the bottom, giving the wire screen a diameter of about two inches. This funnel is connected by a brass coupling to a brass nipple soldered into the lid of a Mason jar. Another nipple is also soldered through the lid of the Mason jar and this connects with a pipe leading to the vacuum pump, and I have a series of these with a valve between each Mason jar and the main pipe. The space in the jar is exhausted by a garage compressor, using the vacuum side instead of the pressure side. This compressor I drive with a motor and we get in the jars a vacuum equal to twenty-six inches of mercury.

In using the filter I shut off the valve and pour my asbestos and water mixture, which is very dilute, on to the wire gauze in the funnel and then open the valve. The result is a very thin asbestos mat distributed all over the screen. The flour solution to be filtered is allowed to settle and the clearest portion poured onto the filter. I can usually filter 200 cc. in less than five minutes and the filtrate comes through even brighter than it does in using filter paper. This apparatus does away with the slow process of filtering these solutions and also prevents accidents by the decrease of water pressure which we used to have in using a water pump, whereby the hydrant water ran back through the pump into your filtrate.

I also use this same pump on the same line of pipe to exhaust Gooch crucibles for fiber and sugar determinations, and I find that a good strong vacuum like this allows me to make sugar filtrations in very much less time and I find that I can filter almost any fibre determination through asbestos in a Gooch in about ten minutes. Of course we get much quicker results if the clearer portion of the fibre solution is decanted from the fibre itself and that portion washed in last.

On the copper funnels, of course, you do not pour any solutions that would be corrosive, such as acids. They are intended only for neutral solutions.

In making the outfit I have used quarter inch pipe and valves throughout and find them entirely sufficient.

One other thing of interest that I have found out since I have had my machine built is that a Mason jar with two nipples extending through the lid should be placed near the pump to keep water, rust and other materials from clogging the valve. The compressor for this apparatus is driven by a one-half horse power motor and the compressor driven at a speed of 200 revolutions per minute.

A good strong vacuum machine like this is of real value in a laboratory, and I shall be glad to give further details to any one wishing to install a similar apparatus.

A. W. ESTABROOK,
Kansas City, Mo.

PROTEIN FACTORS

A discussion of the different protein factors in common use is quite a fruitful source of argument, even among some very good cereal chemists. It is possible to find references in the literature varying from 5.7 to 6.37. This is due of course to the use of the word protein in a general way, relating to a group of organic substances. Each individual protein body will have a factor peculiar to itself.

It was as far back as 1893-94 that Osborne led the way from hazy ignorance in the field of protein analysis, to a uniform method of attack. As a result of his researches we are using to-day the factor 5.7 for wheat. At that time he was able to separate some five distinct proteins in this grain, by means of their differences in solubility in water, salt solution, and alcohol. *These were purified and subjected individually to combustion analysis. On the average they were found to contain 17.6 per cent of nitrogen. From this the factor 5.7 is at once derived. Glaidin, the chief protein in wheat, gave 17.66 per cent nitrogen, and analyses of the other four gave approximately the same percentage composition for this constituent.

So it is well to remember that, when using the factor 5.7, we are assuming that all the nitrogen determined as present, is in the form of pure protein nitrogen of a percentage composition such as that N-17.6. This leaves out of consideration organic nitrogen in other forms, and slight variations in the relative amounts of different proteins present from time to time. Differences of this kind however are usually so small as to fall within the limits of experimental error, and so the protein content of a flour is quite accurately determined by the factor 5.7.

On the other hand it may be noted that some official standards for flour safeguard themselves by omitting entirely any reference to protein content. They simply state the minimum percentage of organic nitrogen necessarily present. It may be interesting to quote here a reference to the Canadian standard for flour, G932, 1910. It reads as follows: "Flour is the fine, clean sound product made by bolting wheat meal and contains not more

*Journal Chem. Soc. 16, p. 526.

than 13.5 per cent moisture, not less than 1.25 per cent organic nitrogen, not more than two parts per million of nitrite reacting nitrogen, not more than (1) per cent ash, and not more than 0.50 per cent of fibre." It is then just a question whether there is any need to report in a flour analysis anything more than what is actually determined; namely, the percentage of organic nitrogen found present. Certainly the use of a factor, although customary, does not clothe the result with any more real meaning.

In comparing reported protein values it is necessary to remember that sometimes the common or "crude" protein factor 6.25 has been used. This is recognized everywhere as the proper or conventional factor to use in the case of cattle feeds, brans, shorts, feed flours, and registered mixtures. It is definitely quoted in the J. A. O. A. C. as late as May, 1916, Pt. 2, p. 22. This again is a straight assumption. On the average the nitrogen present in the substance is taken as belonging to a protein containing 16 per cent of nitrogen. No confusion arises when it is understood that this factor refers only to what is termed "crude protein." The word "crude" is omitted in many cases, but is always inferred when reporting analyses of this kind.

It seems to me to be a very good thing at times to stop and recollect just where the line runs between actually observed phenomena and adopted convention. When we are able to define exactly what we mean by our words, we are beginning to know exactly what we are doing. The closer we hold to reporting only the result of our analysis, and no more, the better chemistry it will always be.

S. E. WESTMAN,
Public Analyst, Ottawa, Can.

ANALYSIS OF KANSAS HARD WHEAT PATENT FLOUR FROM 1915 AND 1916 CROP

Sample of 65% patent from	Crop 1915	Crop 1916
Date flour was made	9-11-16	9-11-16
	Per cent	Per cent
Moisture—Results calculated to a 13.5% basis	13.50	13.50
Ash	.356	.386
Total protein N x 5.7	9.65	10.28
Protein soluble in 1% Na C1 solution	2.00	2.09
Protein soluble in 5% K 2 S O 4 solution	1.33	1.19
Gliadin (protein soluble in 70% alcohol)	5.57	5.82
Glutenin (by difference)	2.75	3.27
Per cent of gliadin in total protein	57.72	56.61
Water soluble protein (40 min. extraction at 25°c)	1.91	1.71
Acidity as lactic acid (40 min. at 25°c)	0.081	0.081
Acidity as lactic acid (official method 40°c)	0.085	0.085
Acidity as lactic acid (40 min. extraction at 10°c)	0.054	0.054
Cold water extract (official method)	5.66	4.68
Water extract (40 min. extraction at 25°c)	8.50	6.58
Reducing sugar as crystalized maltose which developed in 40 min. extraction with water at 25°c	4.58	2.96
Color of flour	99	100
Color of bread	99	100
Volume of loaf	101	100
Texture of crumb	99	100
Quality of the bread	99	100
Loss during fermentation	2.16	2.36
Loss during baking	15.5	15.0
Fermenting period	94	100
Diastatic value	154.7	100

COMMENTS ON ANALYSIS

The average protein content of the 1915 crop would run higher than the above sample, but it was impossible to get a sample with higher protein at the time the analyses were made.

The ash is higher on the 1916 crop and the protein will probably average about the same (10%), this being sufficient to produce a good loaf of bread.

It will be noticed that the acidity is the same which would indicate that this test is not suitable to identify flours which were made from partly sprouted wheat or such wheats as were on the market of the 1915 crop.

The acidity bears a constant relation to the ash content and could be used to indicate the grade of flour as does the ash test. When the ash is high, the acidity is also high, so in case an acidity test was made on a flour without taking in consideration the amount of ash the results would be of no value.

The amounts of cold water extract and reducing sugar will be found more valuable than the acidity test in determining unsound flours, however, the grade of flour should again be taken in consideration as the amounts will increase as the grade decreases.

It will be noticed that the amount of water soluble solids and the reducing sugar which were developed during extraction with water is much lower on the 1916 crop, which indicates a more sound wheat.

The percentage of gliadin in the total protein is about the same in both the 1915 and 1916 crops and as far as the development of the loaf is concerned, both would be considered good.

The fermenting period was much less on the 1915 crop, requiring 94% of the time required to mature the dough of the 1916 crop.

The texture, flavor and quality of the bread is much better on the 1916 crop.

A. R. SASSE.

THE EFFECT ON THE TEST AND WEIGHT OF WHEAT PRODUCED BY THE ADDITION OF WATER.

However false as I believe it to be, there is a notion among some millers that the grain dealers from whom they buy their milling wheat, sprinkle or otherwise add water to it during loading in order to increase the weight. Some contend that the could be done at a profit while on the other hand, others are convinced that the loss due to lowering the test would overbalance any profit from increase in number of bushels.

In order to satisfy ourselves on this point we undertook to simulate the supposed conditions and thus were led to make the following experiments:

Good hard wheat testing 59 pounds and having a moisture content of 12.7% was used. Portions of 1000. grams each were taken and placed in large fruit jars. That weight in grams was used because it is numerically the same as the number of bushels in an average size car of wheat. A total of ten portions was prepared; this permitted of five different sets of conditions being studied in duplicate. Portion "A" was preserved without any addition of moisture. To sample "B" 1% of water was added; to "C," 2%, and so on, increasing 1% with each one till "E" was reached. The wheat for the moisture determination was taken from the duplicate each time so that the other portion would be large enough for making the weight test on.

The wheat to which the moisture had been added was well agitated in the jars and then allowed to stand without exposure to the air till the following morning. Then the total weight, test weight and moisture content of each one was determined and the wheat then poured out into pans and placed in a room where the windows were open. Owing to the high moisture content at the beginning

and the fact that the atmosphere was very dry during the experiment, there was a great loss of moisture even on the untreated sample. The samples were tested thereafter at intervals of three, six and sixteen days. I have calculated the profit or loss per thousand bushels with wheat at seventy cents, at one dollar, and at one dollar and thirty cents per bushel. I used the dockage system in use at this station which is, 59 pounds, par; 58 pounds, 1c dockage; and 2c per bushel for every pound below 58 pounds. To these figures must be added the expense of the operation of wetting the wheat, and this would vary with the different conditions.

The results show, with one exception, a larger loss for the treated wheat than for the untreated wheat. This one exception it will be noticed was for the high priced wheat on the day following the addition of one per cent water. In no case did the treated wheat regain the original test weight. The financial loss due to lowering of the test, with the one exception, was greater with every sample than the financial gain due to increase in weight.

Laboratory of Wichita Mill
& Elevator Co.
FRED H. LOOMIS.

CHART

Date 1916	Test	Moist. %	Weight	Moist. % added	Loss or gain per 1000 bu. at 70c	$1.00	$1.30
			PORTION "A"				
Feb. 11	59.	12.7	1000.	0.	$0.	$0.	$0.
Feb. 12	59.	12.7	1000.	0.	0.	0.	0.
Feb. 15	59.	12.3	996.8	0.	2.24	3.20	4.16
Feb. 19	59.5	10.8	985.	0.	5.58	10.08	14.52
Feb. 28	59.5	10.1	975.	0.	12.63	20.13	27.26
			PORTION "B"				
Feb. 11	12.7	1000.	1.				
Feb. 12	58.	13.7	1009.3		3.58	.79	2.20
Feb. 15	58.1	12.8	1001.8		8.75	9.21	7.67
Feb. 19	58.6	10.8	986.		14.73	18.93	23.14
Feb. 28	58.5	9.9	974.		23.07	30.87	38.67
			PORTION "C"				
Feb. 11	59.	12.7	1000.	2.			
Feb. 12	57.	14.7	1019.6		16.86	10.98	5.10
Feb. 15	57.6	13.2	1010.1		13.13	10.10	7.07
Feb. 19	58.	10.6	989.		17.59	20.89	24.19
Feb. 28	58.	9.9	975.		27.25	34.75	42.25
			PORTION "D"				
Feb. 11	59.	12.7	1000.	3.			
Feb. 12	56.	15.4	1029.		31.15	22.45	13.75
Feb. 15	56.7	13.9	1017.1		28.71	23.58	18.45
Feb. 19	57.4	11.	991.	35.	35.33	38.73	41.43
Feb. 28	57.4	9.9	974.		47.42	55.22	63.02
			PORTION "E"				
Feb. 11	59.	12.7	1000.	4.			
Feb. 12	56.	15.9	1038.8		25.28	13.64	22.00
Feb. 15	56.3	14.5	1023.8		34.53	27.39	20.25
Feb. 19	57.	11.	994.5		33.68	35.33	36.98
Feb. 28	57.	9.9	974.		47.42	55.22	63.02

NOTES ON THE SUGAR DETERMINATION

When appointed to a committee last February to investigate the sugars in flour, I'll admit I had but seldom determined them up to that time, but I've had some valuable experience with them since. The proposed method of the Association was first tried, using the Munson & Walker method, but, on burning the cuprous oxide to cupric oxide, I found that something besides the cuprous oxide was present and being weighed. Four tests, using 50 cc. of the flour solution, gave the following results, the Cu. 2-0 being burned to Cu. O:

	Cu. from Cu. 2-0	Cu. from Cu. 0
1.	0.3850	0.3550
2.	0.3909	0.3564
3.	0.3587	0.3364
4.	0.3968	0.3706

Numbers 1 and 2 were porcelain Gooch crucibles prepared with an asbestos mat according to Leach, p. 594.

Numbers 3 and 4 were Alundum crucibles porosity, No. 306, which I do not consider accurate for this work, as they either permit the precipitate to pass through them, or if an asbestos mat is used to cover the inside of the crucible, they are difficult to wash clean.

After the above experiment the Defren-O'Sullivan method as given in Leach's Food Inspection and Analysis, page 594 was adopted. In case some are unfamiliar with the method, it is as follows:

Mix 15 cc. of Fehling's copper solution with 15 cc. of the tartrate solution in a quarter liter flask and add 50 cc. distilled water. Place the flask and contents in a boiling water bath and allow to remain five minutes. Then from a pipette run in 10 cc. of flour solution and allow the flask to remain in the boiling water bath just fifteen minutes after the addition of the flour solution, remove and with the aid of suction, filter the contents into a prepared Gooch crucible. Wash with boiling water until the solution ceases to be alkaline. Dry the crucible and finally heat to dull redness for fifteen minutes to convert the cuprous oxide to the cupric form.

This method gave very good results and was a more convenient one to use.

It was suggested at our last meeting that the soluble albumens in the flour solution might reduce a little copper if they were not removed in some manner, and boiling the solution was suggested.

After centrifuging the flour solution for five minutes, I removed all the clarified solution from both tubes and mixed well. Immediately determined the sugars in 10 cc. of the solution. Also took 50 cc. in a small beaker and boiled it three minutes, counting from the time the first steam bubble passed through the solution, cooled and replaced the water lost by evaporation, and then filtered. Determined the sugars in 10 cc. of the filtered solution. At first I did not think this filtering was necessary, but a couple of tests on the unfiltered solution gave high results. In the table, solution "A" was not boiled, while "B" was boiled three minutes.

Mr. W. B. Smith, of Kansas City, kindly sent me his method of picric acid clarification of meat solutions, I change it to meet our conditions, and I think it the most convenient method of clarifying this solution. It was as follows:

Take 100 cc. of the centrifuged flour solution in a 200 cc. graduated flask, add 4 cc. of a 20% solution of Phosphotungstic acid and 0.5 gm. of solid picric acid, shake well, fill to the mark, and filter. Make 100 cc. of the filtered solution to 110 cc. by the addition of 8 cc. of concentrated HCl and 2 cc. of distilled water, shake well and filter. It is best to let this solution stand for a few minutes after shaking, and the precipitate will settle so it can be filtered very rapidly, or

the flask may be slightly heated to hasten the precipitation. Every 22 cc. of the filtrate represents 1 gm. of flour and this was the amount I used to determine the sugars. In the accompanying table, column A gives the results on the solution as centrifuged alone, while B gives the results of the centrifuged and boiled solution and C the results of the picric acid clarification. As will be noticed, the flour increased in sugars. The three tests, A, 1; B, 1; and C, 1; each being on the same solution, while tests 2 and 3 where made about 10 days apart. I cannot say whether the increase is due to the drying of the flour, or whether it is an actual increase of sugars in the flour itself. All weights are in milligrams:

A.

	Cu. 0	Maltose
1	88.7	64.5
2	93.6	68.0
3	94.6	68.7

B.

	Cu. 0	Maltose
1	87.3	63.5
2	91.5	66.5
3	90.9	66.2

C.

	Cu. 0	Maltose
1	89.2	64.9
2	90.2	65.6
3	92.5	67.3

In the reduction of the copper solution with the picric acid clarification, if the regular Fehling alkaline tartrate solution is used, about 3 gms. of solid NaOH will have to be added to overcome the acidity of the solution. Bertrand's solutions are recommended for use in this process and then it is not necessary to add any extra NaOH. Mr. Mitchell gave me a hint that may prove very helpful. He said that the addition of 1% concentrated NaOH or KOH to the flour solution after centrifuging, would keep the sugars in the solution practically the same for 24 hours. I had no occasion to use the knowledge, but it is surely worth knowing.

C. R. SOUTHWELL.

ABSTRACTS

Brief statement of the topics discussed at the Cereal Conference in Minneapolis during the week of July 15, 1916—*Modern Miller*, July 15, 1916.

Reply of President Weaver to article from Professor Jago. Weaver points out the unreliability of judging quality of flour by washed "gluten," the influences that cause these errors, the relative exaggerated valuation placed on this test by some chemists. He concludes that the washed "gluten" is dying a natural death.—*Modern Miller*, August 12, 1916.

"Discussion of Flour Tests," by George L. Teller, of the Columbus Laboratories. Teller plainly states his position on the question of Protein and Gluten and concludes that there is no confusion at present in the use of the terms.—*Modern Miller*, September 30, 1916.

Comparative baking tests and Analysis of Hard and Soft Winter Wheat Flour, by J. A. Wilson. He defines the terms used in grading flour samples and gives a table of comparison for a series of tests. Of special note is his statement of his method of determining "gluten."—*Southwestern Grain and Flour Journal*, September 1, 1916.

Flour as a Food, Prof. Harry Snyder. Address before the F. O. M. A. in session at St. Louis.—*Southwestern Grain and Flour Journal.*

Gluten, by William Jago. The author explains his understanding of the term "gluten" and gives a brief history of its establishment in usage. He takes the attitude that the gluten test (qualitative) is one of the most reliable of the laboratory tests.—*Milling*, issues of May 10 and 17, 1916.

Gluten, by William Jago. Reply to Mr. H. E. Weaver's article which appeared in *Milling*, August 26, 1916. —*Milling*, September 16, 1916.

Official Report of American Society of Milling and Baking Technology.—

Milling Experiments, 1915.—*Operative Miller*, September, 1916.

Protein and Gluten Defined, L. Dunton. It is pointed out that any confusion that has arisen is due to ignorance on the part of the persons reporting these determinations and to a tendency on the part of these same operators to report things not actually determined.—*Operative Miller*, October, 1916.

Gluten and Protein in Wheat and Wheat Flour. A list of abstracts on this subject.—*Operative Miller*, November, 1916.

Appreciation of the Baking Quality of Flour through the Soluble Nitrogenous Matter, E. Lammens.—*Operative Miller*, November, 1916.

Investigation of the Ratio of total Protein to Water Soluble Protein with reference to baking qualities of Flour. *Bakers' Weekly*, November 11, 1916.

Gliadin and Gluten in Flour.—*Bakers' Weekly*, November 11, 1916.

Science in baking with reference to Yeast foods, by R. Mallen.—*Bakers' Review*, November, 1916.

Reply to above, by Dr. Lee.—*Bakers' Review*, November, 1916.

Gluten—What is the value of the Gluten test by James Miekle.—*Milling* October 21, 1916.

Comparative Analysis

Last spring in March samples of patent bakers and straight grade Kansas flour were sent out to the members of the Association and request made for analysis and baking tests. The results are here compiled for comparison. Sample "A" was a straight, "B" and "D" were patent, and "C" was a baker's grade. The percentages were about 98, 70 and 28.

TABLE SHOWING A COMPARISON OF RESULTS ON SAMPLE "A"

Refetence No.	1	2	3	4	5	6	7
Moisture	10.35	11.05	10.44	12.25	10.98	10.53	11.2
Ash	.432	.44	.451	.445	.30	.424	.43
Absorption	64.8	63.3	60.	.69			66.1
Acidity	.126	.17	.117	.135	.108	.152	.112
Sol. Solids	9.17	6.8	19.28	10.57	5.73	15.94	11.07
Reducing Sug.	3.79	2.50		5.96	1.46		2.6
Tot. Prot. Nx5.7	11.64	11.72	11.8	11.17	13.2	11.01	11.07
Color of flour			Poor	Ex .96		V. G.	1.
Lbs. dough per bbl.			314.				
Ferment. Period			287.				140.
Volume of loaf	138.1		119.	200.		147.	163.
Color of crumb	96.		Poor	Ex. .96		100.	Nor.
Texture of Bread	.96		Exc.	Ex. .96		99.5	Nor.

TABLE SHOWING A COMPARISON OF RESULTS ON SAMPLES "B" AND "C"

Reference No.	14B	15B	16B	17B
Moisture	12.42	12.8	12.3	12.4
Ash	.37	.376	.386	.371
Absorption	61.68	58.	62.5	62.
Acidity	.110	.147	.108	.108
Sol. Solids	9.81	9.8	9.97	10.06
Red. Sugars	5.63	6.87	4.29	5.34
Tot. Prot. Nx5.7	10.41	10.16	11.17	10.65
Color of flour			99.	100.
Lbs. of dough per bbl.		328.		
Ferm. Period		248.		
Vol. of loaf		141.	175.	142.
Color of crumb		99.8	99.	99.5
Texture of bread		O. K.	100.	100.
	C.	C.	C.	C.
Moisture	12.5	13.	11.9	12.3
Ash	.69	.684	.695	.680
Absorption	62.66	58.5	63.3	62.
Acidity	.207	.228	.225	.230
Sol. Solids	9.03	12.6	10.98	10.96
Red. Sugars	11.14	9.42	5.10	4.98
Tot. Prot. Nx5.7	12.32	12.28	12.67	12.56
Color of flour			88.	89.
Vol. of loaf		132.	155.	137.
Color of crumb		90.	38.	89.
Texture of bread		O. K.	97.	96.

TABLE SHOWING A COMPARISON OF RESULTS ON SAMPLES "D"

Reference No.	10	11	12	13
Moisture	11.28	10.4	9.28	10.54
Ash	.386	.360	.384	.396
Absorption	61.	62.6	66.5	61.2
Acidity	.121	.135	.252	.164
Sol. Solids	9.59	10.59	13.33	9.03
Red. Sugars	3.52	4.21	5.84	4.6
Tot. Prot. Nx5.7	11.29	11.24	11.6	11.32
Color of flour	99.	99.5		
Vol. of loaf	148.	150.	152.	144.
Color of crumb	99.	99.	100.	100.
Texture		100.	100.	99.5

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21850. Beakers, Pyrex Glass, Griffin's low form, with spout.

Capacity, cc.	50	100	150	250	400	600
Number in original case	216	156	156	168	84	72
Each, net	**.13**	**.15**	**.17**	**.19**	**.27**	**.33**
Capacity, cc.	800	1000	1300	1500	2000	2500
Num er in original case	48	48	24	24	12	12
Each, net	**.38**	**.54**	**.65**	**.73**	**.98**	**1.13**

28118. Flasks, Pyrex Glass, with flat bottom and vial mouth.

Capacity, cc.	50	100	150	200	300	400
Number in original case	192	168	108	144	96	84
Each, net	**.12**	**.13**	**.16**	**.18**	**.21**	**.26**
Capacity, cc.	500	700	1000	1500	2000	3000
Number in original case	72	36	36	24	18	12
Each, net	**.29**	**.36**	**.43**	**.51**	**.60**	**.76**

28174. Flasks, Pyrex Glass, Erlenmeyer.

Capacity, cc.	25	50	100	150	200	250	300
Number in original case	360	276	132	252	144	132	132
Each, net	**.10**	**.11**	**.12**	**.13**	**.15**	**.17**	**.19**
Capacity, cc.		500	600	750	1000	1500	2000
Number in original case		72	60	48	36	24	24
Each, net		**.27**	**.29**	**.33**	**.42**	**.51**	**.60**

28290. Flasks, Pyrex Glass, Kjeldahl.

Capacity, cc.	300	500	800
Number in original case	48	36	36
Each, net	**.28**	**.37**	**.45**

Pyrex glass is also available in a number of other shapes than the above, i. e., tall form beakers, round bottom and vial mouth flasks, flat bottom and heavy ring-neck flasks, round bottom and short ring-neck flasks, extraction flasks, distilling flasks, ignition tubes, etc., complete price list of which is sent upon request.

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